

REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 10 to incorporate therein the amount of epoxy resin contained in the resin composition as previously set forth in claim 50. In light of amendments to claim 10, this amount of epoxy resin, previously set forth in claim 50, has been deleted from claim 50.

In addition, Applicants are adding new claims 88-92 to the application. Claims 88 and 89, each dependent on claim 10, further define amount of the epoxy resin contained in the resin composition, consistent with the description on page 15 of Applicants' specification. Claims 90-92, each dependent on claim 10, define amount of the at least one kind of epoxy resin having a biphenyl structure included in the resin composition, based upon the total weight of the epoxy resin therein. See page 15 of Applicants' specification.

Furthermore, enclosed herewith please find a Declaration Under 37 CFR 1.132 by Y. Mizuno, one of the named inventors in the above-identified application. This Declaration provides experimental data that by including the biphenyl structure-containing epoxy resin as in claim 10, with amount of epoxy resin as in claim 10, unexpectedly better results are achieved. Specifically, note the experimentation conducted, described on pages 2-5 of the enclosed Declaration. Note also the experimental results as set forth in Tables 1-1 and 1-2 on pages 6 and 7 of the enclosed Declaration.

See also the discussion of the results, set forth in the first three paragraphs on page 8 of the enclosed Declaration. Specifically, unexpectedly better results were achieved where the resin composition included 10-250 parts by weight of the epoxy

resin (in particular, the biphenyl epoxy resin), based on 100 parts by weight of cyanate compound. The resin composition including the epoxy resin as in the present claims, particularly in amounts thereof as in the present claims, had improved humidity resistance, heat resistance at the time of humid conditions, bending strength, elongation, and dielectric characteristics at high frequency band regions. Note the first paragraph on page 8 of the enclosed Declaration. Note also the second paragraph on page 8 of the enclosed Declaration, pointing out that laminated boards with a formulation ratio of biphenyl epoxy resin and cyanate compound as in the present claims, gave good values in dielectric constant at 1 GHz and in dielectric dissipation factor, having values applicable to high end applications for high speed and high frequency regions. In comparison, Examples 8 and 14, prepared with higher amounts than the amounts in the present claims, gave poorer dielectric constant and dielectric dissipation factor values, applicable to applications for middle high speed and high frequency regions. Note also the third paragraph on page 8 of the enclosed Declaration, showing that the laminated boards with amounts of epoxy resin within the scope of the present claims shows good solder heat resistance under humid conditions and high bending strength and elongation, as compared with Examples 1 and 9 prepared with a smaller amount of the epoxy resin and giving poor results in solder heat resistance under humid conditions, bending strength and elongation compared with other laminated boards.

See also the Conclusion in this Declaration, in the paragraph bridging pages 8 and 9 thereof.

It is respectfully submitted that this Declaration provides evidence establishing unexpectedly better results achieved by the present invention, establishing unobviousness of the presently claimed invention even assuming, arguendo, that the

teachings of the applied reference would have established a prima facie case of obviousness (as set forth in the following, it is respectfully submitted that the teachings of the applied reference would not have established such prima facie case).

That is, in view of the foregoing and in view of the following, it is respectfully submitted that all of the claims presently being considered on the merits in the above-identified application patentably distinguish over the teachings of the reference applied by the Examiner in the Office Action mailed January 16, 2009, that is, the teachings of No. WO 01/70885, under the provisions of 35 USC 103.

It is respectfully submitted that this reference as applied by the Examiner would have neither taught nor would have suggested such a resin composition as in the present claims, including, in addition to the recited cyanate ester compound, monovalent phenol compound and polyphenylene ether resin, an epoxy resin containing at least one kind of an epoxy resin having a biphenyl structure in the molecule, wherein the epoxy resin containing at least one kind of an epoxy resin having a biphenyl structure is contained in the composition in an amount of 10-250 parts by weight based on 100 parts by weight of the cyanate ester compound having 2 or more cyanate groups in the molecule and/or a prepolymer thereof. See claim 10.

In addition, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested such resin composition as in the present claims, having features as discussed previously in connection with claim 10, and, additionally, wherein the epoxy resin containing at least one kind of an epoxy resin having a biphenyl structure is contained in an amount of 10-150 parts by weight (see claim 88), in particular, 10-100 parts by

weight (see claim 89), of the cyanate ester having two or more cyanate groups in the molecule and/or a prepolymer thereof.

Moreover, it is respectfully submitted that this applied reference would have neither disclosed nor would have suggested such resin composition as in the present claims, having features as discussed previously in connection with claim 10, and, additionally, wherein an amount of the at least one kind of an epoxy resin having a biphenyl structure, of the total weight of the epoxy resin, is at least 50% by weight (see claim 90), more specifically at least 70% by weight (see claim 91), or is 100% by weight (see claim 92).

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such resin composition as in the present claims, having features as discussed previously in connection with claim 10, and, moreover, wherein the composition includes amount of monovalent phenol compound as in claim 50; and/or wherein the cyanate ester compound or prepolymer thereof is at least one selected from the group set forth in claim 51; and/or wherein the epoxy resin having the biphenyl structure in the molecule is at least one selected from the group set forth in claim 52; and/or wherein the composition includes additional components, of a specified flame retardant (see claim 53) or an antioxidant (see claim 54); and/or a resin varnish obtained by dissolving or dispersing the resin composition of claim 10 in a solvent (see claim 55).

The invention as being considered on the merits herein is directed to a resin composition for printed wiring boards, and use of such resin composition, e.g., in a varnish, to be incorporated in a prepreg and a metal clad laminated board. In particular, the invention as being considered on the merits herein is directed to such

composition and varnish, which can be used satisfactorily for electronic devices in which the operating frequency thereof exceeds 1 GHz.

In recent years, with advances in various devices including mobile communication devices, transmission of huge amounts of information with low loss and high speed is necessary, so that electrical signals having high frequencies have been used. However, at higher frequencies, electric signals likely decrease, so that it is required to use a material having low transmission loss for a printed wiring board to be used in these fields of art. That is, in a high frequency band region of 1 GHz or higher, a material having excellent dielectric characteristics represented by low values in dielectric constant and dielectric dissipation factor is needed.

Use of cyanate ester resins having good dielectric characteristics of a cured product, has attracted attention for printed wiring boards in recent years. Moreover, it has been proposed to provide a resin composition in which a generally used epoxy resin such as a bisphenol A type epoxy resin, a phenol novolac type epoxy resin and a cresol novolac type epoxy resin is formulated with the cyanate ester resin for improvement of humidity or heat resistance. However, these resin compositions are inferior in dielectric characteristics, than those in which no epoxy resin is formulated.

The present inventors have proposed a resin composition having sufficient dielectric characteristics, by modifying a cyanate ester resin with a specific monovalent phenol compound to prepare a phenol-modified cyanate ester resin composition; however, such resin composition has problems in connection with dielectric constant and dielectric dissipation factor, and stability of dielectric characteristics relative to temperature, as described in the paragraph bridging pages 2 and 3 of Applicants' specification.

Other resin compositions for printed wiring boards, utilizing a cyanate ester, are described on pages 3-5 of Applicants' specification, however, problems still exist in connection therewith, with respect to providing satisfactory electrical characteristics and stability thereof, especially under severe conditions.

Against this background, Applicants provide a resin composition for printed wiring boards having good workability and excellent humidity and heat resistance, while also showing particularly excellent dielectric characteristics at high frequencies and excellent stability of dielectric characteristics. Applicants have found that by incorporating an epoxy resin having a biphenyl structure as at least one kind of epoxy resin in the resin composition, together with the cyanate ester compound having two or more cyanate groups in the molecule and/or a prepolymer thereof, as part of the resin composition of the present claims also including a monovalent phenol compound and polyphenylene ether resin, particularly wherein the epoxy resin is included in an amount as in the present claims, objectives of the present invention are achieved. In particular, a printed wiring board with good dielectric characteristics at high frequencies, and with stability of the dielectric characteristics even upon change in temperature, is achieved.

Attention is again directed to the enclosed Declaration, showing unexpectedly better results achieved by compositions according to the present invention, as discussed in detail previously.

In addition, attention is also directed to the experimental data in Applicants' specification. This experimental data must be considered in determining patentability of the presently claimed invention. See In re DeBlauwe, 222 USPQ 191 (CAFC 1984).

Note especially Tables 1, 3, 5 and 7 respectively on pages 48, 59, 70 and 81 of Applicants' specification, describing various Examples within the scope of the present claims, including amount of epoxy resin, and comparative examples; and note the results in connection with each of these Examples and comparative examples, in Tables 2, 4, 6 and 8 respectively on pages 51, 61, 73 and 83, of Applicants' specification. In this regard, note that Table 2 shows results achieved in connection with the compositions in Table 1; Table 4 shows results achieved with respect to compositions in Table 3; Table 6 shows results achieved in connection with compositions in Table 5; and Table 8 shows results achieved in connection with compositions in Table 7.

It is respectfully submitted that the Examples and comparative examples show unexpectedly better results achieved according to the present invention, utilizing an epoxy resin wherein such epoxy resin includes an epoxy resin containing a biphenyl structure in the molecule, with amount of epoxy resin as in the present claims. As to the comparison examples in the Tables, note the discussion of results in Table 2, on page 52, lines 1-20 of Applicants' specification. Note also the discussion of the results in Table 4, on page 62, lines 1-19, of Applicants' specification. See also the discussion of the results in Table 6, on page 74, lines 1-22, of Applicants' specification. And see a discussion concerning the results shown in Table 8, on page 84, lines 1-22, of Applicants' specification.

It is respectfully submitted that this evidence in Applicants' specification shown unexpectedly better results achieved by the presently claimed invention, containing, inter alia, the recited epoxy resin having a biphenyl structure in the molecule, especially containing amounts of the epoxy resin as in the present claims, supporting a conclusion of unobviousness of the presently claimed invention.

In the following, No. WO 01/70885 will be discussed by reference to its corresponding U.S. patent, No. 7,157,506 to Mizuno, et al.

Thus, Mizuno, et al. discloses a resin composition suitable for printed wiring boards for various purposes, as described in column 1, lines 12-21 of this patent. The resin composition is described generally in column 6, lines 6-30, and includes a phenol-modified cyanate ester oligomer containing a polyphenylene ether resin, prepared by a specific method. This patent discloses that an inorganic filler surface-treated with a silicone polymer having at least one specified siloxane unit is included in the composition. In column 15, lines 39-44, of Mizuno. et al., it is disclosed that the resin composition may be incorporated with a variety of resins or additives, for example, flame-retardant, epoxy resin or antioxidant, as required, within limits not harmful to characteristics of the resin composition. As for the epoxy resin, note illustrative epoxy resins set forth in the paragraph bridging columns 16 and 17 of this patent; see also column 17, line 35, describing that the quantity of the epoxy resin, when used, is not limited. Note also column 17, lines 35-42, describing preferred amounts of epoxy resin relative to the cyanate compound.

It is respectfully submitted that this reference discloses compositions optionally including epoxy resin. It is respectfully submitted that this reference does not disclose nor would have suggested, including the epoxy resin as recited in the present claims, especially in amounts as in the present claims, and in particular the unexpectedly better results achieved thereby, s seen in the evidence of record.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently being considered on the merits in the above-identified application are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 511.44961X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By /William I. Solomon/
William I. Solomon
Registration No. 28,565

Enclosure: Declaration Under 37 CFR 1.132 (Y. Mizuno, 9 pp.)

WIS/ksh
1300 17th Street N, Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666